Object-Process Methodology and Its Application to the Visual Semantic Web

Proposal for a Half-Day Tutorial
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Background

A comprehensive system modeling methodology with coherent ontology is essential for system architecting and engineering. Object-Process Methodology is a unifying approach for developing, communicating, supporting and evolving systems of various domains, types, magnitudes and complexities. OPM is founded on well-defined ontology with solid infrastructure; it has clear, formal, single-model semantics expressed bi-modally via graphics and natural language. It enable fast and reliable system modeling; and it caters to domain experts who are not IT professionals and therefore enables them to actively engage in the development process as part of the team. Taught at leading institutions of higher education and used in Industry, OPM has evolved as a significant extension of Object technology which caters equally well to systems' structure (through objects and relations) and behavior (through processes that transform objects). OPM encompasses the entire lifecycle of a software system or product, from concept and initiation through development to deployment.

The Visual Semantic Web (VSW) is a new paradigm for enhancing the current Semantic Web technology. VSW, which is based on OPM, provides for representation of knowledge over the Web in a unified way that caters to human perceptions while also being machine-processable. The advantages of the VSW approach include graphic-text knowledge representation, visual navigability, semantic sentence interpretation, specification of system dynamics, and complexity management.

Tutorial Goals and History

The tutorial will present the underlying OPM ontology and its application for the Visual Semantic Web. It is based in part on material I have been teaching at MIT's Engineering Systems Division as well as the Summer Professional Institute. See http://web.mit.edu/professional/summer/courses/computer/6.18s.html.
A similar tutorial will be presented at the 2003 International Conference on Enterprise Information Systems (ICEIS 2003), see http://www.iceis.org/tutorial.htm

Potential Attendees and Background Knowledge

The target audience includes information technology professionals interested in modeling software systems. Specifically, analysts, designers, modelers, database administrators and system integrators, executives, and project leaders will benefit

from attending the tutorial and applying OPM for the purpose of developing better systems faster and more reliably. Background knowledge in object technology is helpful but not mandatory.

Outline

OPM ontology: Objects, processes, states, and how they relate. Object-Process Diagrams and Object-Process Language, transformations and state transitions, enablers, transformees, fundamental structural relations: aggregation, characterization, generalization and Inheritance, classification-instantiation, complexity management, abstraction and refinement mechanisms, system lifecycle. Semantic Web and Visual Semantic Web: The human-machine language orientation dilemma, graphic knowledge representation, human vs. machine understanding and language readability, the Semantic Web and the RDF Syntax, The Visual Semantic Web Schema, Namespace Specification in VSW using OPM, Summary.

Reading

The main textbook for the course is: Dori, D. *Object-Process Methodology: A Holistic Systems Paradigm*. Springer Verlag, Berlin, Heidelberg, New York, 2002. The book includes a CD with three CASE tools that support OPM and generate natural language from the diagrams. The most advanced of these tools, OPCAT 2, will serve for demonstration of OPM principles and applications during the tutorial and will be given to the attendees free of charge.

Testimony

Mr. Mark Richer, Systems & Applications Architect at Pratt & Whitney Canada (mark.richer@pwc.ca) recently wrote the following about OPM:
"OPM is a methodology designed to facilitate the formal and rigorous description and analysis of systems, be they information systems or physical systems. The striking feature about OPM is that it recognises as peers the notion of Process and Object. This enables OPM to provide true unified modelling of the structural as well as dynamic aspects of a system. This is in contrast to traditional Object Oriented analysis, such as UML, which use a variety of different modelling formats and symbols to accomplish the same end. For this reason, OPM is being used at P&WC to perform requirements elicitation, systems analysis and the development of precise domain specific ontologies.

Another striking feature of OPM is that it combines a graphics based model, termed Object Process Diagram or OPD, with structured formal declarative statements that complement each interaction depicted on the diagram. These declarative statements are termed Object Process Language or OPL paragraphs. The added value of having both views, graphic and semantic, is that it facilitates non-specialist understanding of the resultant analysis. A short-coming of OPM at the present time is its lack of support for mechanical theorem proving, which would provide consistency checking of the system being developed. This becomes critical as the size of the project increases. At P&WC, we have used OPM to develop a axiomized ontology pertaining to P&WC's unique set of Product Configuration Management concepts, which resulted in the generation of thousands of statements in OPL. We would have dearly enjoyed the benefits of mechanical consistency checking on this project.

The above mentioned Configuration Management project has now been expanded to include the participation of consultants from IBM Canada, Enovia Montreal and Enovia Labs in Charlotte N.C. IBM Canada and Enovia have agreed to use OPM as the means to formally and precisely model the concepts embodied by the Enovia LCA (Life Cycle Applications) product as part of an effort to establish the fits and gaps between this product and P&WC's needs.

OPM is also being used for requirements elicitation and systems analysis on a major P&WC/Engineering project to implement an Earned Value Management System (EVMS), which will bring the Engineering Change Request process together with Project Systems capabilities of SAP. This particular project is a full blown J2EE implementation."

In the preface of this course textbook, *Object-Process Methodology – A Holistic Systems Paradigm* (Dori, D., Springer Verlag, 2002), Prof. Edward Crawley, Head of MIT's Aero-Astro Department, who teaches OPM in his Systems Architecture course, wrote:

"Mature disciplines, such as mechanics, are well into the era of symbolic manipulation and prediction. Maturing disciplines, such as human genomics, are in the phase of symbolic representation. OPM is a parallel development in symbolic representation of systems. ... I have used OPM in my System Architecture course at MIT. It has proved an invaluable tool to professional learners in developing models of complex technical systems, such as automobiles, spacecraft and software systems. It allows an explicit representation of the form/function duality, and provides an environment in which various architectural options can be examined. Incorporating OPM into my subject has added the degree of rigor of analysis necessary to move the study of technical system architecture towards that of an engineering discipline.

One can anticipate that there will be many academic applications of OPM. I would consider using it in intermediate or advanced subjects in system engineering, product development, engineering design and software engineering. It is ideal for courses that demonstrate how various disciplines come together to form a multi-disciplinary product."

About the Presenter

Dov Dori is Head of the Information Systems Engineering Area at the Faculty of Industrial Engineering and Management, Technion, Israel Institute of Technology, and Research Affiliate at MIT. Between 1999-2001 he was Visiting Faculty at MIT's Engineering Systems Division and Sloan School of Management. Professor Dori received his B.Sc. in Industrial Engineering and Management from the Technion in 1975, M.Sc. in Operations Research from Tel Aviv University in 1981, and Ph.D. in Computer Science from Weizmann Institute of Science, Israel, in 1988. Between 1978 and 1984 he was Chief Industrial Engineer of MERKAVA Tank Production Plant, and between 1996 and 1998 he was Head of Technion's Area of Information Systems Engineering. His research interests include Systems Development Methodologies, Information Systems Engineering, Computer-Aided Software Engineering and Document Analysis and Recognition. Dov Dori has developed the Machine Drawing Understanding System (MDUS) and Object-Process Methodology (OPM), for which he won several prizes. Between 1999 - 2001 Prof. Dori was Associate Editor of IEEE Transaction on Pattern Analysis and Machine Intelligence (T-PAMI). He is Associate Editor of International Journal of Document Analysis and Recognition and is on the Editorial Board of the International Journal of Pattern Recognition and Artificial Intelligence. He is author/co-editor of four books and author of over 130 publications. He is Fellow of the International Association for Pattern Recognition (IAPR) and Senior Member of IEEE. He has been consultant and invited lecturer for companies, including Pratt and Whitney Canada, Ford Motor Company, FAA, NASA, The MITRE Corporation, Draper Laboratories, Kodak, and others.

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